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DRY EYE MONITORS IN COMPUTERS& MOBILES-VIA WEBCAMS & FRONT CAMS

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Abstract:

Eyes are very important and we have to protect it. Mainly the people who are seeing monitor for a long time they don't blink their eyes for a long duration of time and the solution for this problem is to remind them to blink their eyes periodically. The aim of this paper is to alert the people to blink their eyes within the specified time duration. Here we come with a solution for this problem. The proposed Eye tracking algorithm tracks our eye's Temporal stability and Visual stability using web cams in computers and front cams in mobiles. This will help to maintain a healthy eye for rash video games players, creative work people, project developer, movie watchers, etc. This paper also explains about the Design and Implementation of this System.

Keywords: Eye tracking algorithm, Temporal Stability, Visual Stability, Webcams.

1. Introduction:

Eyes are the important part in our human body. Eyes are very important for a human so it is very important to save. We use our eyes to watch everything. Nowadays working with the personal computer and usage of mobile phones took the major time in our daily life. When usage of these devices improves our life, in the other hand it also leads to serious health problems. The main health issue is eye defects. When we are using the computers or mobile phones our eyes will continuously look in to the screen and forget to blink our eyes periodically which will eventually leads to the dryness in our eyes. If we didn't blink our eyes for long time it might damaging our eyes. To prevent eye from getting dry we have to blink our eyes at least once in ten minutes mostly this occurs when a human works with computer or mobiles. Commonly when we play online games or video games in computers or mobiles we don't use to blink often. We keep our eyes open still the game ends even if the game extends to half an hour. People who work on projects with deadlines and some creative work people like movie editors, animation creators use to concentrate more on screen and will forget to blink their eyes. Still might cause damage to their eyes and cause eye irritation, eye

infection and sometimes cause blindness or night blindness too. In this paper we propose the Dry Eye Monitoring System to track the blinks of the user eyes and to make necessary warnings. The tracking system tracks our eyes. It sends the signal to system which has a clock that sets timer for 5 minutes. If the user didn't blink within the 5 minutes duration, then the system will send a notification on the notification area in mobiles and right-bottom corner of the computers monitor. That is the first warning for the user. When the user receives this warning message, the user must blink their eyes. If the user continues his work without blinking, after 5 minutes another notification will pop up on the centre of the display as a reminder. Even after that if the user didn't response to the notification then the display's brightness gets reduced and again will come back to normal within 2seconds. This 2 second gap will automatically make our eyes to blink.

After examining and analysing the existing systems, we come to introduce the material in a way that will best shape our idea and sound good to our readers. In paper [1] the author comes with the idea of identifying the state of driver whether he is at the state of fatigue or not and if yes then an electroencephalographic signal is given to the drivers to be alert. To identify the driver's state PERCLOS algorithm is used. In the paper [2] the author is explaining his idea to help disabled people who can control their motor through eye and head movement. Many types of approaches has been explained in this paper. In the paper [3] the author has analysed two components Catch-up Saccades and Smooth Pursuit. They analyses the eye movement with different movement speeds and in different direction and concluded with a new method to evaluate subject's pursuit. Paper [4] explains about EOG signals. In paper [6] the author has tried to replace mouse or trackball with eye movement and control the system with eye movements. They have explained about the techniques that can be used to detect the problems we might face due to that. In paper [7] author tries to use webcams to input users' gestures of skin-based face tracking system.

2. System Design:

Blinking activity is done randomly by opening and closing our eyelids. It is necessary to keep eye moist and eliminates irritants from the surface of cornea and conjunctiva. If we keep our eyes open for a long time, our eye becomes dry, sore and will cause pain in eyes. Often getting irritated and eye infection may occur when our eye is open that might reduce our eye power. In this paper we will explain our idea and algorithms which will help to develop the idea.

2.1 Design:

Step 1: User starts using the computer/mobile

Step 2: Tracking System is initiated.

Step 3: Blinkcount value is set to 0 initially.

Step 4: Timer is initialized to 0 milliseconds.

Step 5: Tracking System continuously detects the users face and recognize the user eye blinks. When a blink is detected, blink count is incremented and timer is reset to 0.

Step 6: The system continuously checks the timer value and the blink count.

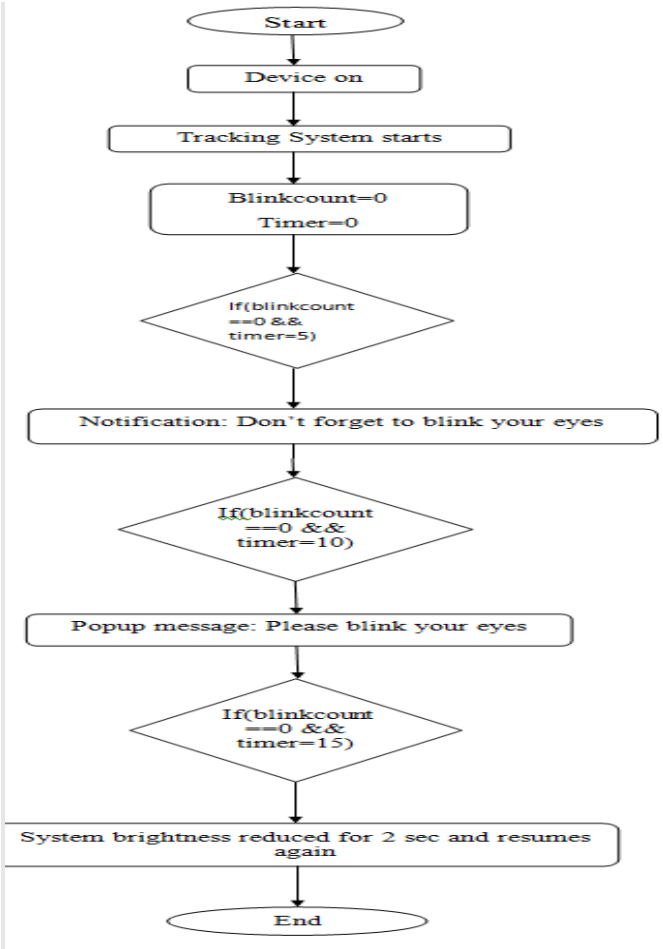
Step 7: When the timer reaches 5 mins and the blink count is 0, a Notification is popped in the right bottom of the computer screen notifying that "Don't forget to blink your eyes.

Step 8When the timer reaches 10 mins, a popup message is given in the centre of the screen says "Please blink your Eyes".

Step 9: When the timer reaches 15 mins, brightness of the screen is reduced to 0 for 2 seconds and resumed back.

Step 10: Resuming the screen after 2 seconds will never affect the process and when the brightness is reduced for 2 seconds automatically our eyes will blink since it is the nature of our eye.

Step 11: After this process gets over again the blink count and timer is set to 0 and again a new process is started until the user stops the process.



3. Implementation:

The Dry Eye Monitor System is implemented in three steps.

- FACE DETECTION METHOD
- EYE TRACKING ALGORITHM
- INPUT METHOD

These segments are explained in the following sections.

3.1 Face Detection Method:

There are 2 methods to detect the face. They are

- *Haar FACE TRACKING*
- *CAMSHIFT*

Haar FACE TRACKING is a method where we identify face and eyes. Initially it is trained with hundreds of sample face image. After the training is completed it is used in Region Of Interest (ROI) in an input face image.Face image is capture in form of rectangle and the pixels of face is calculated. Using the difference between the total pixels in the rectangle and pixels of the face can help to identify the face and its position.

f(x)=Sum rectangle (total pixel level) – Sumblack rectangle (pixel gray level)

There are 3 commonly used features:

1. Edge features
2. Line features
3. Centre surrounded features

*CAMSHIFT ALGORITHM*that is Continuously Adaptive Mean-Shift Algorithmis based on robust non-parametric technique.

There are some steps to follow:

1. Set the Region Of Interest (ROI) of the likelihood dissemination picture to the whole picture.
2. Select an underlying area of the Mean Shift look window. The chosen area is the target dissemination to be followed.
3. Ascertain a shading likelihood circulation of the locale focused at the Mean Shift seek window.
4. Repeat Mean Shift calculation to discover the centroid of the likelihood picture. Store the 0^{th} minute (dissemination region) and centroid area.

5. For the accompanying edge, focus the inquiry window at the mean area found in Step 4 and set the window size to a component of the 0^{th} minute. Go to Step 3.

3.2 Eye Tracking Algorithm:

There are 2 algorithms to detect eyes. They are

- *TEMPLATE MATCHING ALGORITHM*
- *ADAPTIVE PRINCIPAL COMPONENTS ANALYSIS METHOD*

*TEMPLATE MATCHING ALGORITHM*is where we match the image of eye pattern manually and detect the eye (pupil) shape. To find the available eye correlation points from the constant figures are calculated and fixed. The calculated and fixed constant eye value is used to match with the available eye to find the shape and state of eye. This is an easy method to implement.

Another method called *ADAPTIVE PRINCIPAL COMPONENTS ANALYSIS METHOD*where eye is scaled and measured. Height, width and shape are scaled manually there and the shape and state of eye is calculated. This is little difficult to implement exactly but the result is so perfect.

3.3 Input Method:

Webcam: When user needs to start the process he can do that with a Graphical user Interface (GUI).

3.4 Brightness Control:

1. Current screen brightness value is got.
2. A screen brightness default value is from 0 to 255.
3. Set screen brightness Value.
4. If timer reaches 15 minutes then the brightness is changed to 0, So that the brightness is reduced.
5. After 2 seconds that is 2000 milliseconds the screen brightness is changed to current brightness value.

3.5 Notification Methods:

1. Create builder for Notification.
2. Set properties for Notification.
3. Incorporate Actions to be performed.
4. Display the Notification.

3.6 For Eye Tracking:

Blink Detection Method:

• Screen-mounted webcam: low picture quality, huge face area

• Environment: simulated + normal light, no IR illum.

• Appearance-based: no unequivocal restriction of eye segments

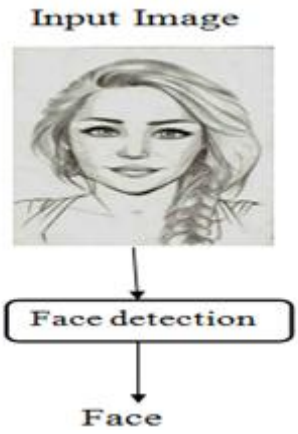
• Real-time operation: 20 fps (Low frames per second) → 100 ms min. Blink duration.

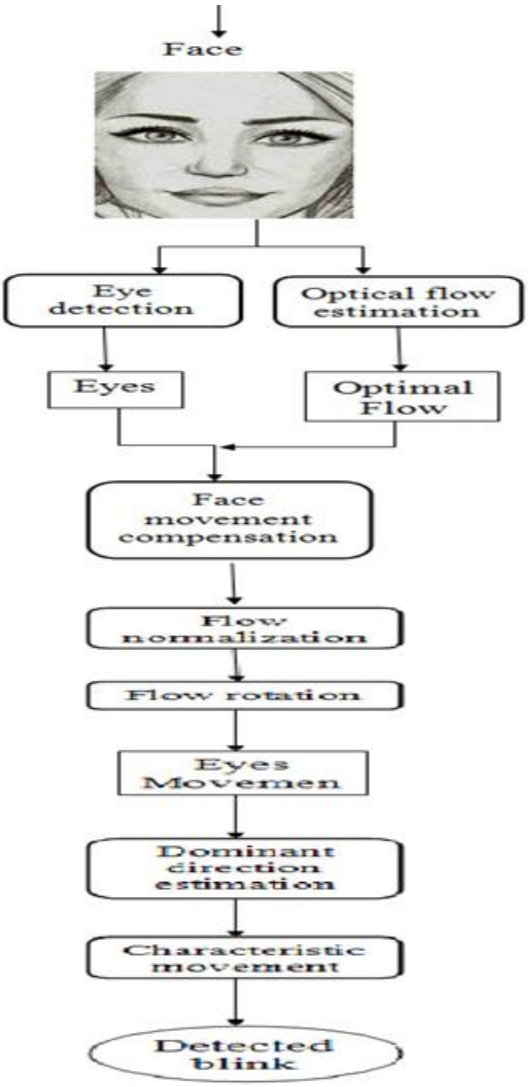


Opened Eye Drowsy Eye Closed Eye

- When eye is open, pupil is seemed to be in circle shape.
- When eye is in drowsy state, pupil is seemed to be in semi-circle shape.
- When eye is close, pupil is not visible or pupil is seemed to be in straight line.
- Each time when pupil is missing or smaller than semi-circle then it is taken as a blink.

Here is how a blink is detected and their process flow is given below.





4. Conclusion:

Eye defects due to the usage of computers and mobilesare increasing nowadays. One main reason is looking the screen for long time without blinking of our eye. Not only eye problems it may create other problems too like backpain. By sending a notification user will come to know that they are working for a long time in the same position and they get slightly gets distracted from their work and they can relax for a while. To avoid such problems we are using the tracking system via web cams that detects our eye blinking time and informing us to blink our eyes if the time is prolong without blinking.

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